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ACUTE MYELOGENIC LEUKÆMIA.

BY FRANK BILLINGS, M.D.,
PROFESSOR OF MEDICINE, RUSH MEDICAL COLLEGE,

AND

JOSEPH A. CAPPS, M.D.,
INSTRUCTOR OF MEDICINE, RUSH MEDICAL COLLEGE.

ACUTE leukæmia has become a well-known and generally recognized disease. Nearly always it is of the lymphatic type. The following case is of the myelogenic variety, and, therefore, is of more than ordinary interest:

The patient was a man, aged sixty-eight years, free from hereditary taint. He was abstemious in his habits, and gave no history of venereal infection. When fifty years old he suffered from nervous prostration. Nine years ago he was jaundiced from the passage of gallstones. Seven years ago he was subject to uræmic headache, brought on by Bright's disease. Four years ago a fistula in ano developed.

The present illness began in August, 1899, with an ulceration which formed at the root of a decayed tooth. Weakness and loss of flesh were present. The jaw-bone was carious. A blood examination was made at this time by Dr. R. C. Cabot, and showed a normal condition.

September 20th. The weakness had increased and the patient complained of anorexia, indigestion, constipation, and sleeplessness. The body was emaciated. Temperature slightly elevated. Marked pallor. The spleen could not be felt, and no hemorrhages were in evidence. The glands were not swollen.

Blood Examination. Hæmoglobin, 40 per cent.; leucocytes, 2,000,000; whites, 540,000. The stained specimens showed only moderate poikilocytosis and 2160 nucleated red cells to 1 c.mm., most of which were normoblasts. Small mononuclear leucocytes, 4 per cent.; large mononuclears, 39.2 per cent.; polynuclear neutrophiles, 24 per cent.; eosinophiles, 1.6 per cent.; mast-cells, 0.8 per cent. There were 30.4

per cent. of myelocytes, of which 2.4 per cent. contained eosinophilic granules.

The condition of the patient grew rapidly worse. Hemorrhages took place under the skin and from the gum in the region of the necrosed bone. The temperature daily reached 102° to 103°, and he sweat profusely. Œdema of the lungs appeared. Along with the progressive loss of flesh a mental hebetude developed.

By October 7th the anæmia had become very marked, and the gums were spongy and bleeding. Pulse rapid. The heart was moderately enlarged to the left, and a soft systolic murmur was heard at the apex; aortic second sound accentuated. The spleen was distinctly palpable one finger's breadth below the costal edge. Urine scanty, large amount of albumin, many granular and hyaline casts.

Death occurred from asthenia about two months after the onset. The last blood examination, on October 7th, showed hæmoglobin, 30 per cent.; erythrocytes, 1,700,000; whites, 374,000. In the differential count were 2618 nucleated red cells to 1 c.mm., most of them normoblasts. Small mononuclear leucocytes, 1.6 per cent.; large mononuclears, 22 per cent.; polynuclear neutrophiles, 21.2 per cent.; eosinophiles, 0.4 per cent.; mast-cells, 0.4 per cent.; myelocytes, 54.4 per cent., of which 0.8 per cent. were eosinophilic. Many free nuclei were scattered about in both specimens. The classification of myelocytes and large mononuclears was often arbitrary, since the granulations were frequently faint. The mononuclear cells corresponded in size and appearance to the myelocytes, save for the absence of granules. The large mononuclears varied in diameter from 14 to 20 μ , while the myelocytes ranged from 12 to 20 μ .

The close relationship between these two groups of granular and non-granular mononuclear cells is seen in both counts. The latter count has more myelocytes and fewer large mononuclears than the former, but the totals are only slightly altered (69.6 per cent. and 76.4 per cent., respectively). The later blood count might be looked upon as an older blood product than the earlier, as shown by the greater number of granular elements; but we think the difference is dependent chiefly on the technique of staining. By using a high heat the granules are not stained well; by using a lower temperature the granules are plain.

For many years leukæmia was looked upon as a disease that always ran a chronic course. Ebstein first called attention to the acute forms of leukæmia. Fränkel made an exhaustive study of all the cases in the literature in 1895, including ten cases of his own. He drew this important conclusion: That all cases of acute leukæmia are lymphæmias, in which the increase of white cells chiefly or almost exclusively consists of large or small lymphocytes. He does not admit the existence of an acute myelogenous leukæmia.

Pinkus states that all cases of acute leukæmia up to that time (1901) described were of the lymphatic type. Ehrlich and Lazarus in the same year also observe that no instance of undoubted myelogenous leukæmia running an acute course had yet come to their notice.

Pinkus and Lazarus incorrectly state that Cabot has reported two

probable cases. Dr. Cabot informs us, however, that all of his acute cases have been lymphatic.

Most writers on the subject have accepted the view of Fränkel.

Fussell, Jopson, and Taylor, in their review of fifty-six cases of acute leukæmia, consider the disease lymphatic, because in three cases only were myelocytes present to any extent.

Walz, however, enters a protest against classifying acute leukæmia as necessarily lymphatic, for the reason that "it is not yet certain that there are not cases of acute myelogenic leukæmia."

Grawitz, likewise, vigorously maintains that an acute leukæmia may rarely present either a mixed or a medullary blood finding.

Ewing clearly recognizes an acute myelæmia and points out its essential characteristics.

More recently Hirschfeld and Alexander have reported a case of unquestioned acute myelogenic leukæmia.

We have attempted to review the literature and critically select from it those cases which resemble the picture of acute myelogenic leukæmia. Many reports give such inadequate blood findings that they are not considered.

For the sake of convenience we have placed all the possible cases under two groups: 1. Clear cases of acute myelogenic leukæmia. 2. Probable cases of acute myelogenic leukæmia.

1. We have made a brief résumé of the clear cases:

CASE I.—Van der Wey's case was a girl, aged twenty-three years, who had enjoyed excellent health in the past. Illness began with headache, dizziness, ringing in the ears, and pain in the left shoulder.

Status Præsens. Few swollen glands in the cervical, axillary, sub-maxillary, inguinal, and cubital regions, varying in size from a pea to a bean. Spleen palpable. Hæmoglobin, 60 per cent.; reds, 2,840,000; whites, 175,000. Most of the whites (60 per cent.) were myelocytes containing faint or distinct granules; 1.9 per cent. eosinophiles; few small mononuclears; polynuclears, 33 per cent.

Six weeks later the condition, hitherto stationary, became suddenly worse. Fever, repeated nose-bleed, loss of weight, and rapid anæmia occurred. Hæmoglobin, 22 per cent.; reds, 900,000; whites, 300,000. The large mononuclears predominated, although myelocytes were still abundant. Polynuclears fell to 3.7 per cent.; eosinophiles to 0.3 per cent. The large mononuclears and myelocytes together constituted 96 per cent. of all the white cells. The small mononuclears were few. Death three months after illness began.

Autopsy. Slight enlargement of external and internal glands. Marrow soft, gray, and looked like a mixture of pus with blood.

Van der Wey inclines to call this case a transformation of a chronic myelogenic to an acute lymphatic leukæmia, since the granular elements (myelocytes) were largely replaced by the non-granular (large mononuclear). Without question the large mononuclear cells were

myeloid cells, some containing faint granules, which explains his difficulty in separating them from the myelocytes.

Thompson and Ewing report the following case :

CASE II.—A woman, aged twenty-one years, with no history of syphilis or other severe illness. For six months had experienced frontal headache, but was in fair health until six weeks previous, when she was taken with sore throat that lasted two weeks. Then the right arm became swollen, red, and painful, and remained so for three weeks. Three days before observation she fainted and fell, striking the left side, after which she suffered from severe pain in the abdomen. Later she had repeated attacks of vomiting, and of fever, ranging from 102° to 105°. The only hemorrhage evident was in the skin of the nose. The spleen was scarcely palpable. No enlargement of the lymph glands. Death took place eleven days after the first examination, and less than eight weeks from the probable initial symptom.

The blood count, made two days after admission, was 1,290,000 red cells; hæmoglobin, 20 per cent. Marked leucocytosis, estimated at about 50,000. Of the leucocytes 5 per cent. were myelocytes of medium size. No nucleated red cells seen. Five days later, whites about 100,000; mononuclears, 33 per cent.; polynuclears, 55 per cent.; myelocytes, 12 per cent.; occasional eosinophiles and abundant normoblasts. After death, mononuclears, 17 per cent.; polynuclears, 48 per cent.; eosinophiles, 0.3 per cent.; myelocytes, 17 per cent. No mast-cells. The granules of the myelocytes were often indistinct.

Post-mortem. Leukæmic deposits in the spleen, liver, abdominal lymph nodes, and marrow. Microscopically the marrow showed entire absence of fat-cells and a diffuse growth of myelocytes.

This case is a typical acute myelæmia, as was recognized by the authors at the autopsy.

CASE III.—Grawitz gives the history of a spinster, aged forty-two years, whose health was previously good. The onset was marked by long-continued hemorrhage following the extraction of fourteen teeth at one sitting. The patient entered the hospital with a severe stomatitis and necrosis of the jaw. On account of the great prostration, retinal hemorrhages, and enlargement of the spleen, the diagnosis was made of acute leukæmia. The cervical glands were moderately swollen. The spleen extended three fingers below the costal edge.

Leucocytes, 190,000; small mononuclears, 5 per cent.; large mononuclears, 15 per cent.; polynuclears, 10 per cent.; 60 per cent. were neutrophile and 10 per cent. eosinophile myelocytes, or 70 per cent. of myelocytes in all.

Death took place in two weeks.

Grawitz calls the case "an outspoken medullary or mixed blood picture in a very acutely progressing leukæmia."

CASE IV.—Ewing describes the case of a middle-aged negro who, for two months, was ill with gingivitis, hemorrhages from the mouth and bowels, fever, and progressive anæmia. The superficial glands were not much enlarged. The spleen was moderately increased in size. This case was correctly diagnosed as acute leukæmia during life by

means of the marked leucocytosis and the great number of neutrophile myelocytes. The patient died with symptoms of sudden collapse and enormous tympanites. Soon after death there was rapid gaseous decomposition due to the *bacillus aërogenes capsulatus*. The bone-marrow was puriform.

CASE V.—A second case of Ewing was a young man whose illness ran a rapid course. The glands and spleen were slightly enlarged. Hæmoglobin, 20 per cent.; reds, 1,080,000.

Post-mortem. The blood collected from the axillary vein showed 686,000 erythrocytes, 31,000 leucocytes. Mononuclears, mostly small, 61 per cent.; neutrophilic myelocytes, 31 per cent.; eosinophilic myelocytes, 2 per cent.; polynuclears, 6 per cent., and a few mast-cells. Nucleated reds moderately abundant; usually of small size. No distinct megaloblasts. Moderate difference in size of red cells. Smears from the marrow show chiefly myelocytes.

In the lymph glands was a uniform growth of large mononuclear cells, non-granular. The spleen showed many small lymphocytes.

Both of these cases Ewing considers are acute myelæmias, as determined by ante-mortem and post-mortem findings.

CASE VI.—Hirschfeld and Alexander narrate their observation of a man, aged twenty-one years, whose illness began with a swelling in the foot. Soon after a swelling of the under jaw came on, treated by extraction of the tooth. The wound bled profusely, and later an ulcer formed. Submaxillary glands slightly swollen, but the spleen was not palpable. At the first examination the hæmoglobin was 35 per cent., reds 2,000,000, no quantitative nor qualitative change in the white cells. Rapidly the pallor increased, and there was a moderate fever.

In the course of five weeks the spleen and glands steadily grew larger; the leucocytes increased to 64,000; the hæmoglobin fell to 10 per cent. and the reds to 1,125,000. By differential staining it was seen that the large mononuclears varied from 16 to 20 per cent. and the myelocytes from 5 to 8.6 per cent. Normoblasts present in small number. Death occurred two months after the onset.

Post-mortem. The bone-marrow consisted chiefly of myelocytes and large mononuclears. The spleen tissue was made up almost entirely of granular cells, as well as giant cells. Smears of the spleen were in no way different from those of the bone-marrow. The glands also showed an infiltration of myelocytes. The ulcer of the jaw showed a compact cell mass consisting of myelocytes, polynuclears, and eosinophiles.

CASE VII.—Michaelis publishes an account of a woman in her fiftieth year. Pneumonia and peritonitis were the only important previous ailments. She passed the menopause at forty. The onset of her illness was ten weeks preceding entrance to the hospital. She complained of dulness, cough, expectoration, and a stitch in the left hypochondrium, which steadily increased.

Status Præsens. No glandular enlargement. Throat, mouth, and tonsils normal. There was slight fever. The spleen almost filled the left side of the belly and was soft. Urine negative.

Dulness, dyspnœa, and pain in the splenic region progressed gradually, and the skin grew paler. Excepting for slight hemorrhages in the retina, the objective findings remained unaltered. Hæmoglobin, 40 per cent.; reds, 3,450,000; whites, 16,000; slight poikilocytosis; small

mononuclears, 20 per cent. ; large mononuclears, 56 per cent. ; polynuclears, 16 per cent. ; eosinophiles, 0.4 per cent. ; mast-cells, 0.4 per cent. ; neutrophile myelocytes, 7.2 per cent. ; normoblasts in moderate numbers. Later both small and large nucleated reds were more numerous.

Death in fifteen weeks from beginning of symptoms.

Autopsy. The bone-marrow contained large numbers of giant granular cells and large mononuclear cells without granules. Myelocytes not so numerous. Marrow cells likewise were found in the lymph glands and spleen.

Michaelis gives cuts illustrating the large mononuclear cells in various stages of transition to the myelocytes.

2. The only cases that seem to fall into this group of probable acute myelogenic leukæmia are the following :

CASE I.—Obrastow reports the case of a seventeen-year-old school-girl, whose illness began with nose-bleed and fever. The spleen, at first scarcely palpable, grew rapidly larger until it was a hand's breadth below the ribs. Moderate swelling of cervical, axillary, and inguinal glands. The hæmoglobin fell to 30 per cent. ; reds, 3,044,000. The leucocytes at the beginning were increased, and before death were in the ratio of 1 to 7 erythrocytes. Myelocytes were present. Death ensued in two weeks after the onset. On post-mortem a diphtheritic inflammation of the soft palate was found, a colitis, and pus cocci in the glands.

CASE II.—Patient was the nurse of the previous case. Six weeks after her death was taken with fever and inflammation of the hard palate. Then petechiæ, albuminuria, and enlargement of the spleen developed. Only the glands about the jaw were swollen. White cells 1 to 9 reds. Later the spleen reached the navel. Myelocytes with faint granules seen. Death in thirty days from the first symptoms.

Both of these cases appear to be infectious, and in both myelocytes were found, but their number is not stated.

Fränkel thought that the large mononuclear cells with faint granules were lymphatic cells, and includes both cases in his series of acute lymphatic leukæmias.

These cells seem to us, however, to be true myelocytes.

CONSIDERATION OF SYMPTOMS. Most of the eight clear cases (see table) began abruptly in the manner of an infection ; four cases had a throat inflammation, and in three there was a necrosis of the jaw or palate. With two exceptions the glands were slightly or moderately enlarged, the cervical group being usually affected. The spleen was always large enough to feel. In only two instances, however, was the edge more than one finger's breadth below the costal margin. Hemorrhages occurred in every case where the history was obtained. Fever was present in most cases, of an irregular, low-grade type. The anæmia was always severe and rapid. Yet poikilocytosis was usually less marked than in a pernicious anæmia correspondingly severe. The

white cells varied from 16,000 to 540,000. The average count is much lower than ordinarily found in the chronic myelogenic leukæmia.

DIAGNOSIS. A number of conditions bear a resemblance to acute myelogenic leukæmia, and some of them have been wrongly described as such. Among the more important sources of error may be mentioned :

1. *Chronic Myelogenic Leukæmia with Acute Exacerbation* (Reimann). The blood picture is quite similar to the acute myelogenic leukæmia, but the patient gives a history of a long-standing illness, and at the first examination a large splenic tumor is present, whereas in the acute type the spleen is scarcely palpable in the first stages.

2. *A Lymphatic Leukæmia Complicated by Some Intercurrent Infection* (Hirschlaff). The appearance of many neutrophile polynuclear cells makes an unusual picture. Myelocytes, however, are few or wanting altogether.

3. *Acute Lymphatic Leukæmia where the Large Mononuclear Cells Predominate*. Selig has described such a case as an "acute mixed leukæmia" on the ground that these cells are from the marrow. In the entire absence of myelocytes this diagnosis is untenable.

4. *Acute infections* associated with a grave and rapid anæmia may give rise to nucleated red corpuscles and myelocytes. Leube reports a case where 14 per cent. of a white count of 10,500 consisted of myelocytes. Yet he regards it not as leukæmia, but as an infection with irritation of the bone-marrow. The white count generally is much lower than in acute myelogenic leukæmia.

5. *Acute exacerbations of pernicious anæmia* may be mistaken for a myelogenic leukæmia, if the blood has not been previously examined. As an illustration of such a blood picture we cite a pernicious anæmia case reported by Billings where two days before death the white count was 34,000, and included 29.4 per cent. of myelocytes.

6. *New-growths involving the bone-marrow* cause blood changes somewhat similar to leukæmia. Myelocytes and nucleated red cells are both present. Türk within the last year was able to correctly diagnose a case in Neusser's clinic during life. He based the conclusion on the enormous number of nucleated red cells present in the blood of both cases. In one case there were over 90,000 per c.mm. Myelocytes were not very numerous. Confusion of marrow neoplasm with acute myelogenic leukæmia is unlikely, because the former runs a chronic course and the anæmia is gradual.

The *differential diagnosis* between acute myelogenic and acute lymphatic leukæmia cannot be made either by the clinical symptoms, the physical findings, or even by the ordinary count of white cells. In all these respects the disease may be identical with acute lymphatic leukæmia. Only by means of differentiating the white corpuscles in a

stained specimen can the type be identified. If the lymphocytes prevail we call the disease lymphatic; if the marrow cells predominate, we call it myelogenic. And herein lies a great difficulty: to determine whether certain cells are of lymphatic or myelogenic origin.

The school of Ehrlich draws a sharp line between the non-granular lymphatic cells and the granular myeloid cells.

Pappenheim, Walz, and their followers believe that the marrow produces all of the myelocytes and large mononuclear "mother cells," all of the neutrophile and eosinophile polynuclear leucocytes, and a certain proportion even of the small lymphocytes. They consider all leukæmias myelogenic with or without a participation of the glands. In favor of this view it is asserted that every well-studied case of lymphatic leukæmia has shown post-mortem an involvement of the bone-marrow. At the same time they concede that both small and large mononuclear cells may also come from the lymph glands.

Naegeli thinks the lymphatic large mononuclear cell can be morphologically distinguished from the myeloid cell or "myeloblast" by its appearance alone.

In practice it is often impossible to say whether the large mononuclear cell is to be classed among the large lymphocytes or the unripe myelocytes. The myeloid cell has usually an eccentrically placed nucleus; the nucleus is often oval; the protoplasm is often faintly granular. We would suggest this as a safe rule to follow: When large mononuclear cells are seen with a considerable number of myelocytes of the same size, and when many of the mononuclears show indistinct granulations, they may be considered as myeloid cells.

In all of the recorded cases of acute myelogenic leukæmia there was difficulty in separating the large mononuclears and the myelocytes, because so many transitional cells with faint, indistinct granules were present. The large mononuclears never were less than 15 per cent., while the myelocytes varied from 8.6 per cent. to 60 per cent. The small mononuclear cells were relatively diminished. Eosinophiles were either absent, present in small number, or increased. Mast-cells were seen in one case only. Nucleated red corpuscles did not form an essential part of the picture, as in the chronic myelogenic type.

Using the published cases as a basis, the blood picture of acute myelogenic leukæmia may be summed up as follows:

1. Anæmia, progressive and severe.
2. A large increase of white blood corpuscles (16,000 to 540,000).
3. A large proportion of the white cells (25 to 96 per cent.) made up of myelocytes, large mononuclear cells of the same size, and faintly granular large mononuclear cells (transitional cells).
4. Eosinophiles, mast-cells, and nucleated red corpuscles may be absent or present in varying numbers.

No.	Observer.	Sex. Age.	Duration.	Mouth Infection.	Glands.	Spleen.	White Count.	Differential Count of Leucocytes.
1	Van der Wey, 1896	F. 23	3 months.	None.	Cervical, sub- maxillary, and lingual vary in size from pea to a bean.	Palpable.	175,000 to 300,000.	Few small mononuclears; polynuclears, 33 per cent.; eosinophiles, 1.9 per cent. Myelocytes, 60 per cent., containing faint and distinct granules. Polynuclears, 3.7 per cent.; eosinophiles, 0.3 per cent.; mononuclears and myelocytes, 96 per cent. The large mononuclears predominate, although myelocytes are plentiful.
2	Thompson and Ewing, 1898	F. 21	8 weeks.	Sore throat.	Normal.	Scarcely palpable.	50,000 to 100,000	At first, myelocytes, 5 per cent.; five days later, lymphocytes, 33 per cent.; polynuclears, 55 per cent.; myelocytes, 12 per cent. After death: Lymphocytes, 17 per cent.; polynuclears, 48 per cent.; eosinophiles, 0.3 per cent.; myelocytes, 17 per cent.; many with indistinct granules.
3	Grawitz, 1900	F. 42	2 weeks.	Stomatitis; necrosis of jaw.	Moderate en- largement of cervical group.	3 fingers below costal border.	190,000.	Small mononuclears, 5 per cent.; large mononuclears, 15 per cent.; polynuclears, 10 per cent.; myelocytes, 60 per ct.
4	Ewing, 1901	M. 34	months.	Gingival hemorrhage from mouth.	Slightly enlarged.	Moderately enlarged.	Marked increase.	Neutrophile myelocytes in great numbers. In other re- spects the blood was typical of myelogenic leukæmia.
5	Ewing, 1901	...	Acute course.	Not stated.	Slightly enlarged.	Moderately enlarged.	31,000.	Small mononuclears, 61 per cent.; polynuclears, 6 per cent.; neutrophile myelocytes, 31 per cent.; eosinophile myelocytes, 2 per cent. Few mast-cells.
6	Hirschfeld and Alexander, 1902	M. 21	2 months.	Necrosis of hard palate.	Cervical, size of pea to pigeon's egg.	One finger be- low costal border.	42,000.	Small mononuclears, 7.4 per cent.; large mononuclears, 19.2 per cent.; polynuclears, 63 per cent.; eosinophiles, 0; myelocytes, 8.6 per cent.
7	Michaelis, 1902	F. 50	15 weeks.	None.	Normal.	Very large.	16,000.	Small mononuclears, 20 per cent.; large mononuclears, 56 per cent.; polynuclears, 16 per cent.; eosinophiles, 0.4 per cent.; mast-cells, 0.4 per cent.; neutrophile myelo- cytes, 7.3 per cent.
8	Billings and Capps.	M. 68	2 months.	Caries of jaw.	Slight enlargement of the cervical.	One finger below the costal border.	540,000 to 374,000.	Small mononuclears, 4 per cent.; large mononuclears, 39.2 per cent.; polynuclears, 24 per cent.; eosinophiles, 1.6 per cent.; myelocytes, 80 per cent.; mast-cells, 0.8 per cent. Small mononuclears, 1.6 per cent.; large mononuclears, 22 per cent.; polynuclears, 21.2 per cent.; eosinophiles, 0.4 per cent.; myelocytes, 54.4 per cent.; mast-cells, 0.4 per cent.

ADDENDUM. Since this article went to press another case has been reported by Türck (*Zeitschrift f. innere Medicin*, No. 13, p. 336), under the title "Acute Myeloid Leukæmia." The duration was not stated. The blood findings were: hæmoglobin, 19 per cent.; erythrocytes, 1,060,000; whites, 42,000. The leucocytes consisted of 14 per cent. lymphocytes, 32 per cent. polynuclears, 47 per cent. myelocytes. Post-mortem the bone-marrow was of grass-green color, and was made up almost exclusively of neutrophile myelocytes and transitional forms.

BIBLIOGRAPHY.

- Billings. Transactions of the Association of American Physicians, 1900.
 Ebstein. Deutsch. Arch. Allg. Med., Band. xlv. p. 343, 1889.
 Ehrlich and Lazarus. Nothnagel's Spec. Path. und Therapie, 1901.
 Ewing. Clinical Pathology of the Blood, 1901, p. 212.
 Fränkel. Deutsch. med. Woch., vol. xxxi. p. 639, 1895.
 Fussell, Jopson, and Taylor. Philadelphia Medical Journal, January, 1899.
 Grawitz. Pathologie des Blutes, 1902, p. 318.
 Hirschfeld and Alexander. Berl. klin. Woch., No. 11, 1902.
 Hirschlaff. Deutsch. Arch. f. klin. Med., vol. lxii. p. 314.
 Leube. Berl. klin. Woch., p. 851, 1900.
 Michaelis. Zeitschr. f. klin. Med., vol. xlv. p. 87, 1902.
 Naegeli. Deutsch. med. Woch., May 3, 1900.
 Obrastow. Ibid., p. 1150, 1890.
 Pappenheim. Virchow's Arch. f. Path. Anat. und Phys., vol. clix. p. 161.
 Pinkus. Nothnagel's Spec. Path. und Therapie, 1901.
 Reimann. Wien. klin. Woch., p. 967, 1899.
 Seelig. Deutsch. Arch. f. klin. Med., vol. liv. p. 537.
 Thompson and Ewing. New York Medical Record, vol. liii. p. 333, 1898.
 Van der Wey. Deutsch. Arch. f. klin. Med., p. 287, 1896.
 Walz. Centralb. f. Pathologie und Allg. Anat., No. 23, 1901.

TUMOR OF THE INTERCAROTID BODY.

A REPORT OF ONE CASE, TOGETHER WITH ALL CASES IN LITERATURE.

BY CHARLES L. SCUDDER, M.D.,

SURGEON TO THE MASSACHUSETTS GENERAL HOSPITAL; ASSISTANT IN CLINICAL AND OPERATIVE SURGERY, HARVARD MEDICAL SCHOOL, BOSTON, MASS.

FIVE cases of tumor of the intercarotid body are recorded in medical literature. Paltauf¹ reports four of these with a most exhaustively systematic study of the structure, development, and pathology of the intercarotid body. Marchand records one case of tumor of this same intercarotid body. These five cases, with the one recorded in this paper, constitute all the known instances in medical experience. The case which I have to report is as follows:

The patient was a woman between twenty and thirty years old. The diagnosis had been made of an enlarged gland in the neck. There was no history of tuberculosis in the family. The woman was well

¹ Beiträge path. Anat. Allgem. Pathologie. Ziegler, Jena, 1892.